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Langley Research Center



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Detecting and Measuring Metabolic Byproducts by Electrochemical Sensing

A new method of detecting certain groups of bacteria is based on sensing a buildup in molecular hydrogen. The apparatus is easy to assemble and use, and it has the added advantage that hydrogen evolution by the test micro-organisms can be measured automatically and accurately. This system has been used to detect and enumerate a variety of gram-negative bacteria of the Enterobacteriaceae group.

The apparatus for measuring hydrogen evolution by the test organisms consists of a 25-mm by 90-mm test tube containing two electrodes, plus nutrient broth and organisms, positioned in a 35° C water bath. Leads from the electrodes are connected to a dc buffer amplifier which, in turn, is connected to a strip-chart recorder. The buffer amplifier serves to match the high impedance of the electrode test system with the recorder. Hydrogen evolution is measured by an increase in voltage in the negative direction and is recorded on the recorder.

The electrodes used are (1) a fiber-junction, calomel, reference electrode, cemented to the test tube cap; and (2) a platinum electrode, formed by shaping a strip of platinum to fit the inside circumference of the test tube. A section of the platinum is positioned outside the tube for attachment to the amplifier lead. During operation, the electrodes and the tube are sterilized by either steam or ultraviolet radiation.

Hydrogen response curves display a lag period, a period of rapid buildup in potential due to hydrogen, and a period of decline in potential. A linear relationship has been established between inoculum size and length of the lag period. Lag times for *Escherichia coli* ranged from 1 hour for 10^6 cells/ml to 7 hours for approximately 1 cell/ml. For each tenfold decrease in inoculum, lag period length increased 60 minutes. Mean cell concentrations at the time of hydrogen evolution were 10^6 /ml. These results indicate the potential application of the hydrogen sensing method for detecting

coliforms and certain other micro-organisms rapidly in a variety of samples.

There are several practical applications for the hydrogen sensing system of detecting micro-organisms, the most obvious being the rapid detection of coliform organisms in water samples. This suggests the possibility of developing remote sampling stations for monitoring potential sources of pollution. Another area of potential application is in clinical laboratories, where the system could be used to detect the majority of urinary tract infections in 2 to 3 hours or less. Other possible areas of use are in the food and dairy industries and in sterility testing programs.

Note:

Requests for further information may be directed to:
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Patent status:

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